Use of Lowrance HDS sonar units on Lakes Mead and Mohave for high-resolution bathymetric mapping

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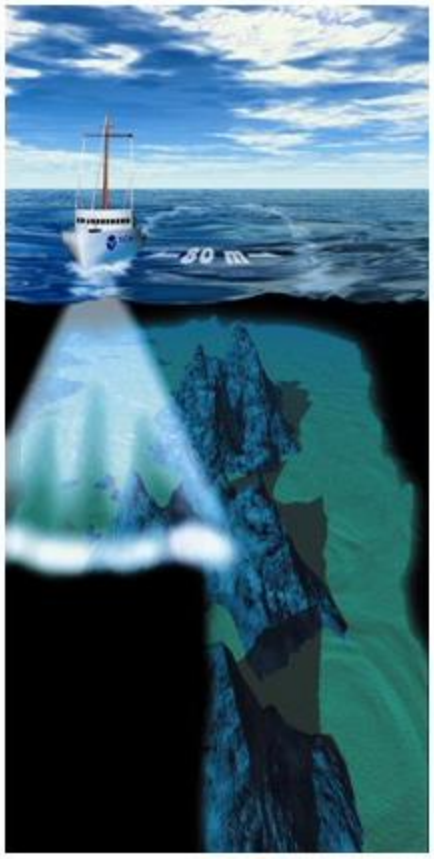
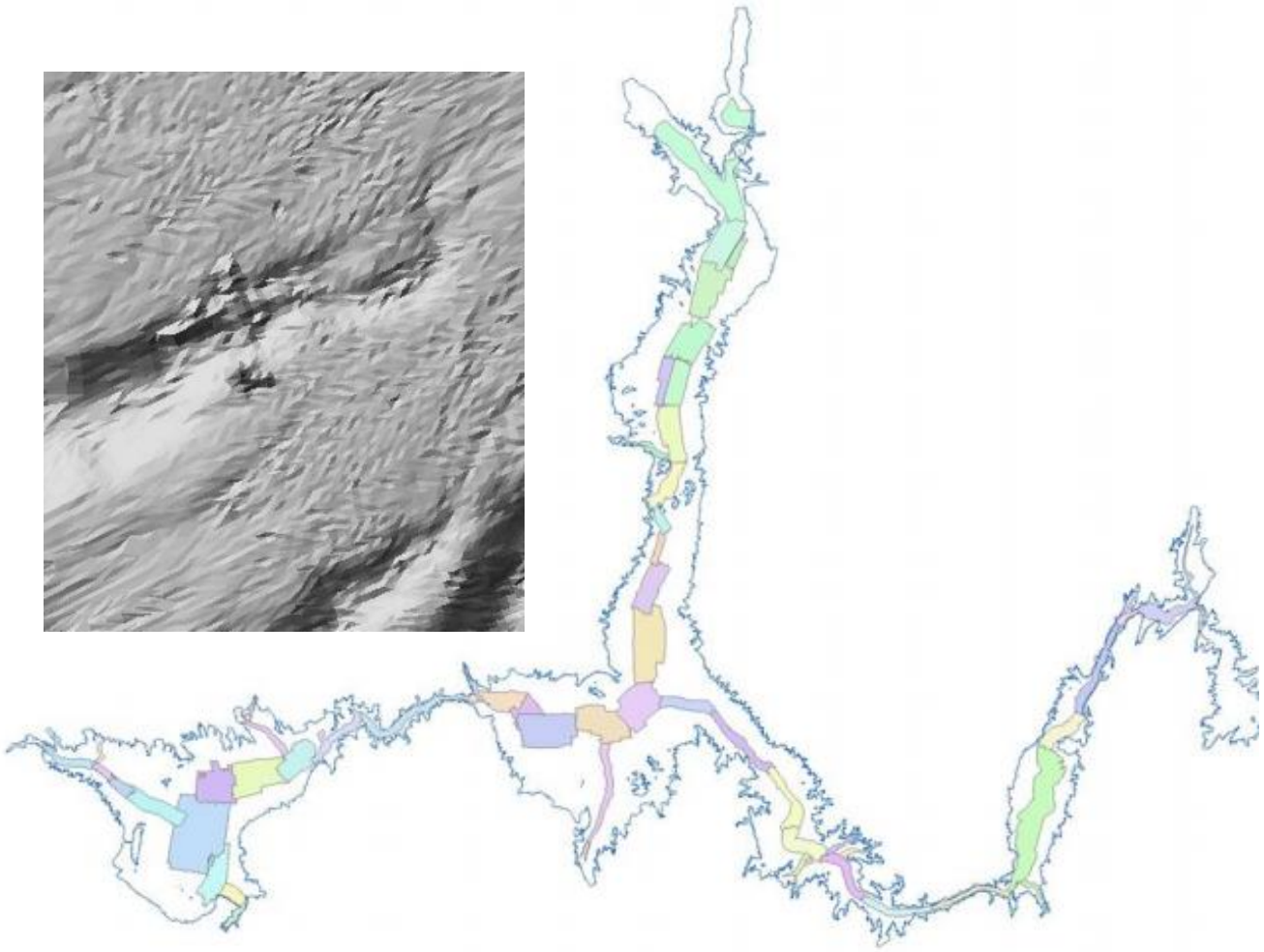
High Resolution Bathymetric Mapping in Lake Mead

US Bureau of Reclamation
2001 Sediment Study

Multi-beam sonar

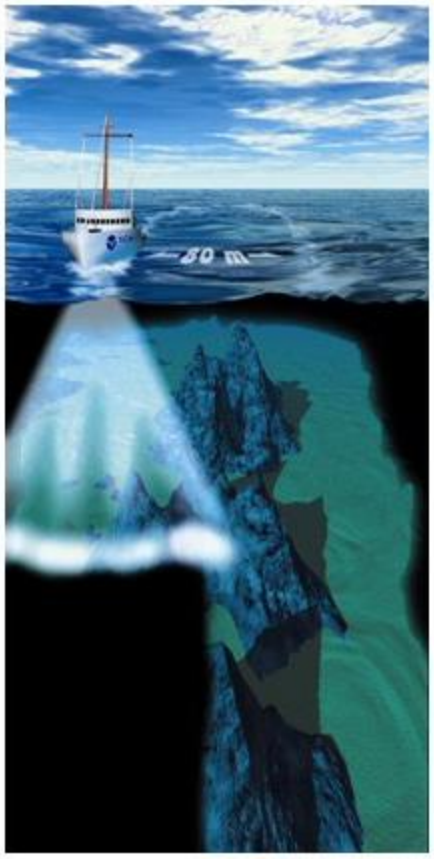


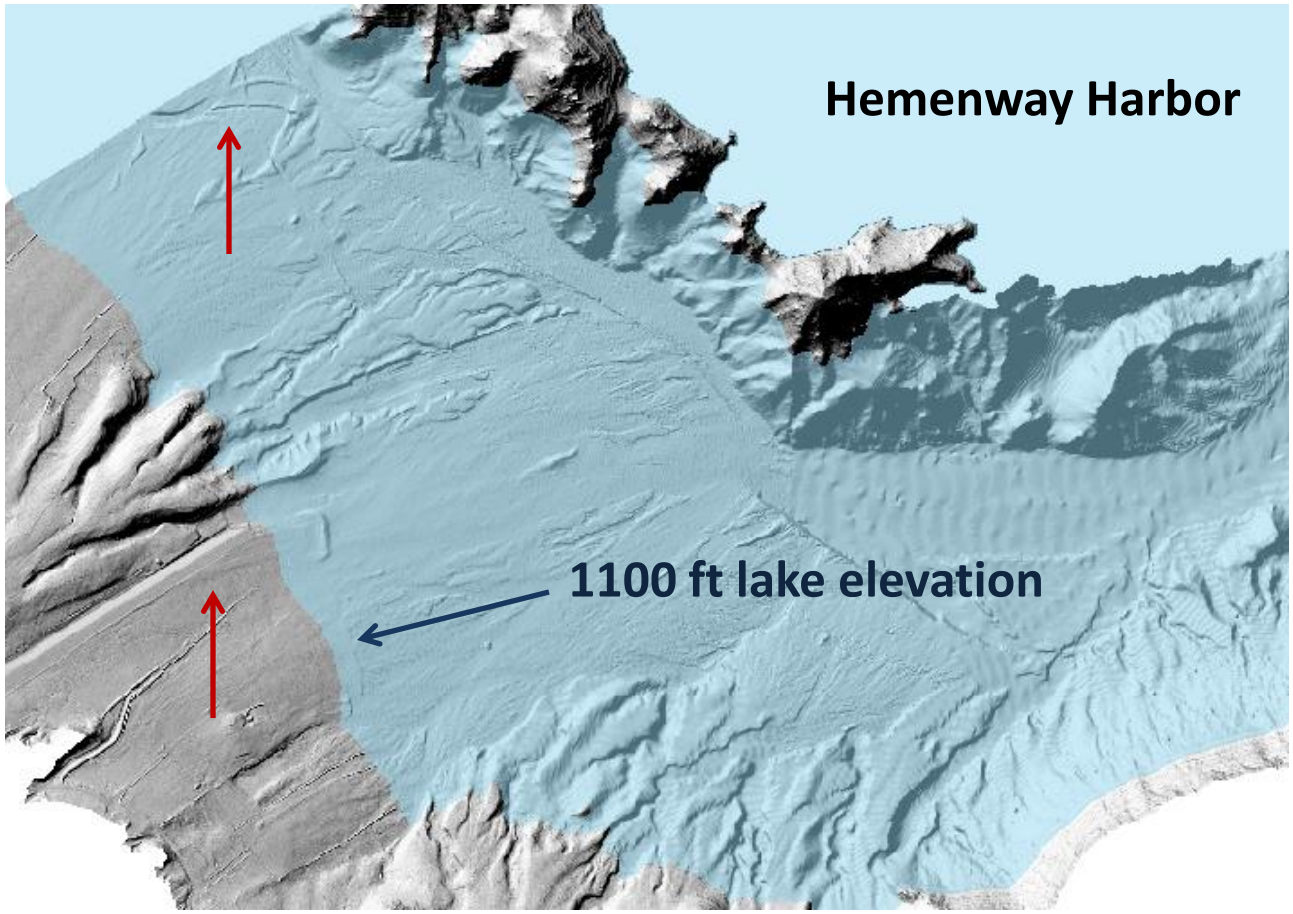


High Resolution Bathymetric Mapping in Lake Mead

National Park Service
2008 Marina Surveys

Multi-beam sonar





High Resolution Bathymetric Mapping in Lake Mead

National Park Service
Ad-hoc surveys

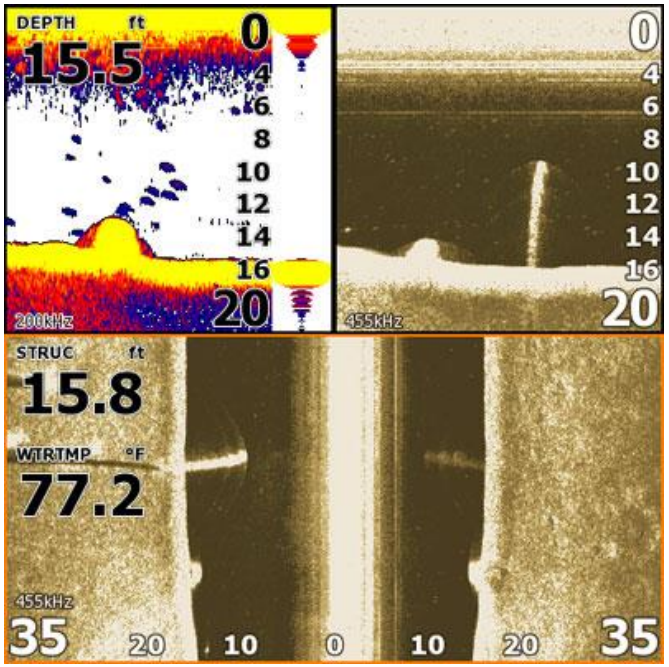
Single-beam sonar

Traditional Fish Finding Sonar

- Low cost
- Limited capability
- Limited detail and resolution
- No ability to record data and post-process

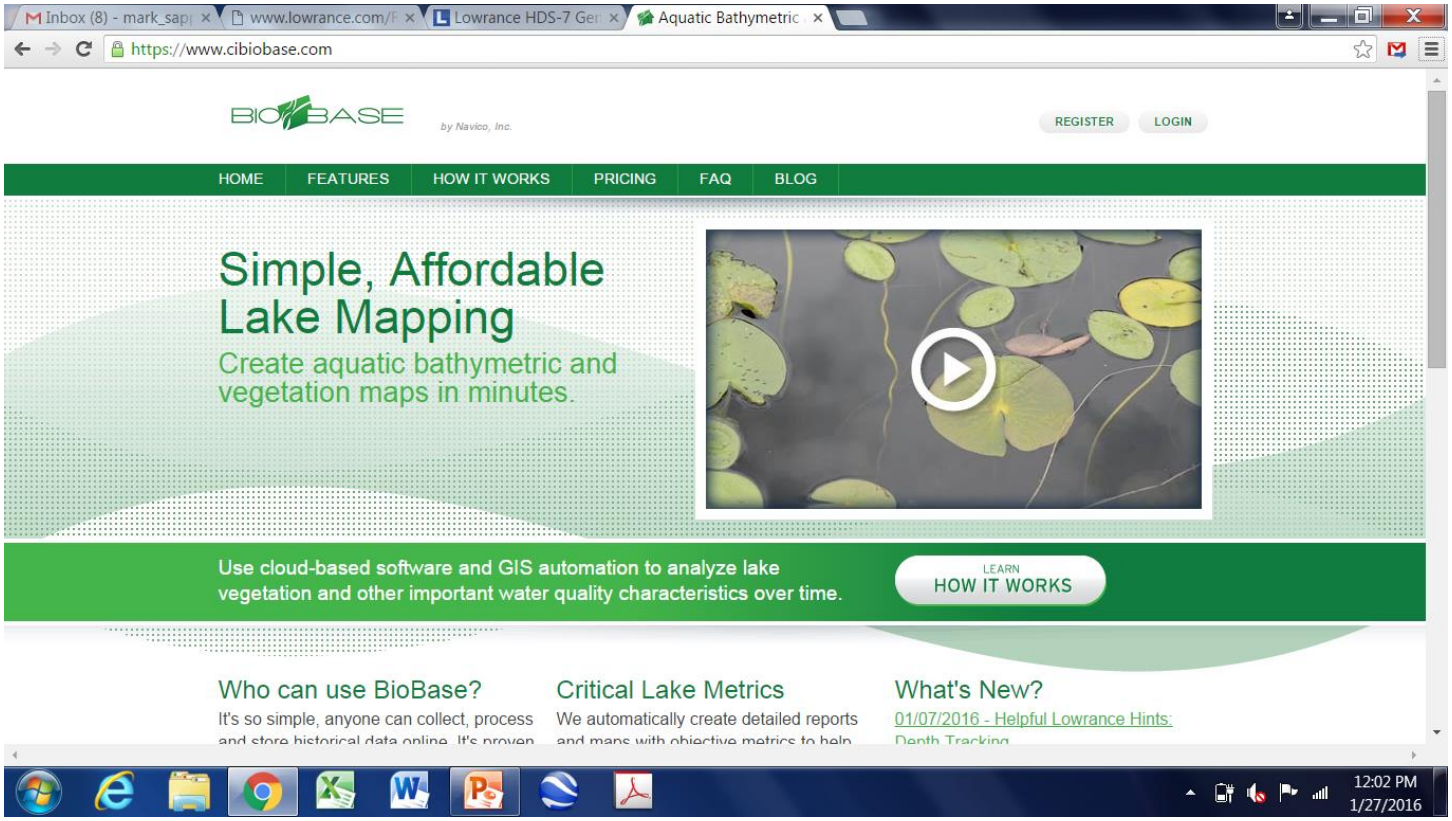
Lowrance HDS Chartplotter (Generation 1)

- Broadband sounder™
- StructureScan™
- 2 SD Cards: maps and data recording



BioBase Software Subscription Service

- Post-process sonar data from Lowrance HDS units
- High-resolution contour maps, vegetation maps, bottom hardness maps, change detection



Overview of data collection and processing

Create transects → Import transects → Log sonar data → Upload sonar data → Review data

Review data → Apply offsets and merge trips → Export outputs → Convert depths to elevations → Convert to surface model

Creating Transects

- ArcMap 10.x
  - Create Fishnet Tool
    - Cell Size Width & Height = Transect Spacing
  - Remove undesired rows/columns
  - Optimize transect orientation, extent
  - Merge polylines into single line feature
  - Project to WGS84
- DNR GPS
  - Save shapefile/feature class as .gpx file

Area of Interest

20m Transects

Logging Sonar Data

- Import transect .gpx to Lowrance chart plotter via SD card

- Chart plotter settings
  - Shallow water fishing mode
  - 10-15 pps ping rate
  - Auto sonar range
  - 200KHz frequency
  - WAAS differential correction enabled

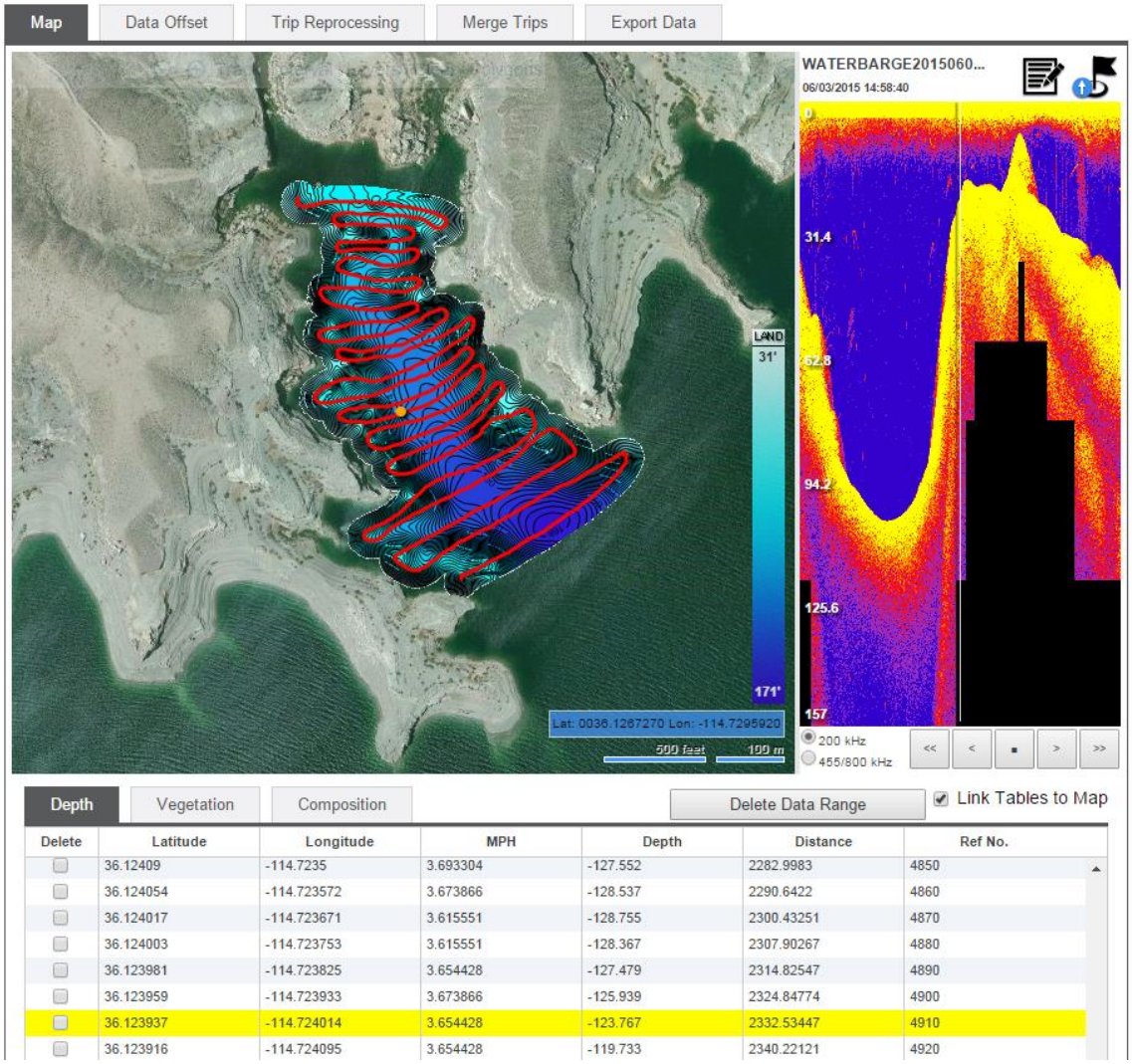
- Recommended logging speed: 4 – 6 mph

- Log sonar (.sl2) in hourly blocks to SD card
  - Mitigate potential data loss
  - Account for changes in lake level

Processing Sonar in BioBase

Client Upload Tool

- Trip replay
- View tracklog, contours, vegetation, and composition
- Apply depth offsets
- Reprocess using appropriate track buffer
- Merge multiple trips into single file
- Export data to CSV file



Delete	Latitude	Longitude	MPH	Depth	Distance	Ref No.
	36.12409	-114.7235	3.693304	-127.552	2282.9983	4850
	36.124054	-114.723572	3.673866	-128.537	2290.6422	4860
	36.124017	-114.723671	3.615551	-128.755	2300.43251	4870
	36.124003	-114.723753	3.615551	-128.367	2307.90267	4880
	36.123981	-114.723825	3.654428	-127.479	2314.82547	4890
	36.123959	-114.723933	3.673866	-125.939	2324.84774	4900
	36.123937	-114.724014	3.654428	-123.767	2332.53447	4910
	36.123916	-114.724095	3.654428	-119.733	2340.22121	4920

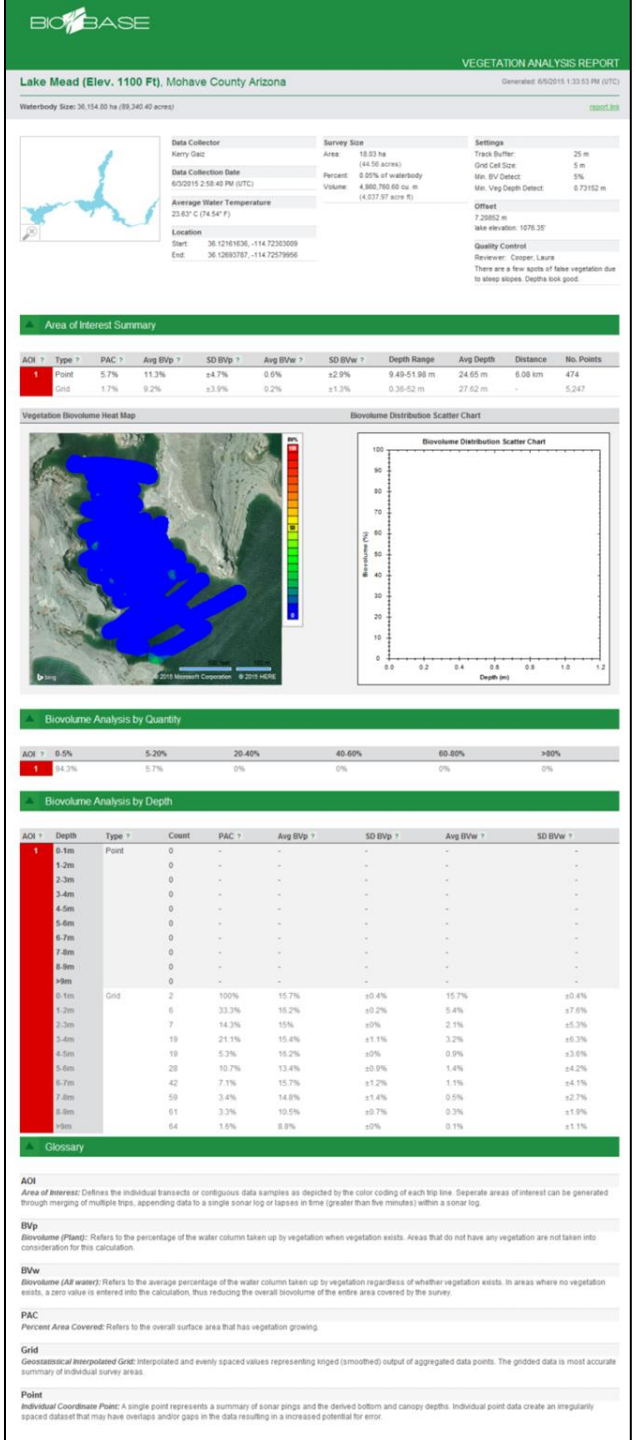
Quality Control

From BioBase

- Report within 24 hours that reviews:
  - General trip info
  - Vegetation
  - Depth

In-house

- Review depth table
  - Remove erroneous depth readings


BIOBASE

VEGETATION ANALYSIS REPORT

Lake Mead (Elev. 1100 Ft), Mohave County Arizona

Area of Interest Summary

Vegetation Biovolume Heat Map

Biovolume Distribution Scatter Chart

Biovolume Analysis by Quantity

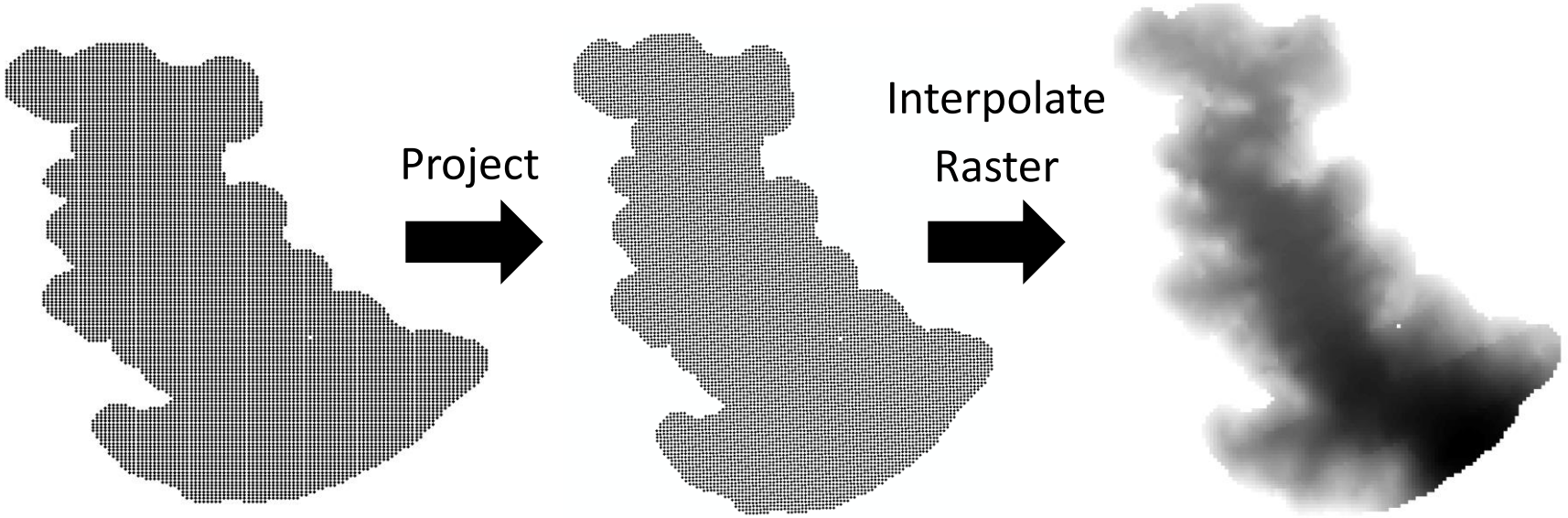
Biovolume Analysis by Depth

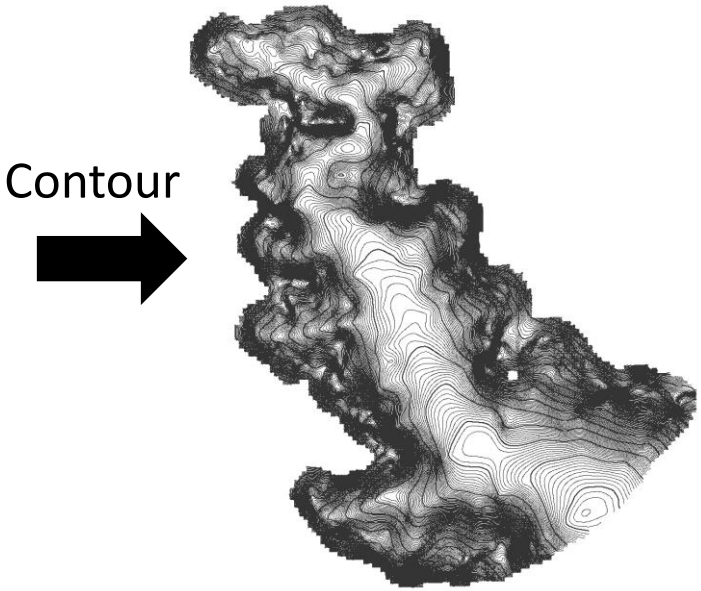
Glossary

Depth | Vegetation | Composition | Delete Data Range | Link Tables to Map

Delete	Latitude	Longitude	MPH	Depth	Distance	Ref No.
	36.125117	-114.723086	3.207343	-76.958	3118.49872	6660
	36.125095	-114.72314	3.285097	-81.491	3123.93398	6670
	36.125073	-114.723194	3.421166	-88.269	3129.36924	6680
	36.125044	-114.723248	3.654428	-95.695	3135.21197	6690
	36.12492	-114.723617	3.576674	-115.514	3142.68204	6740
	36.124898	-114.723698	3.732181	-117.715	3150.36868	6750
	36.124796	-114.723951	3.634989	-121.523	3158.71065	6780

Capabilities: bathymetric contours





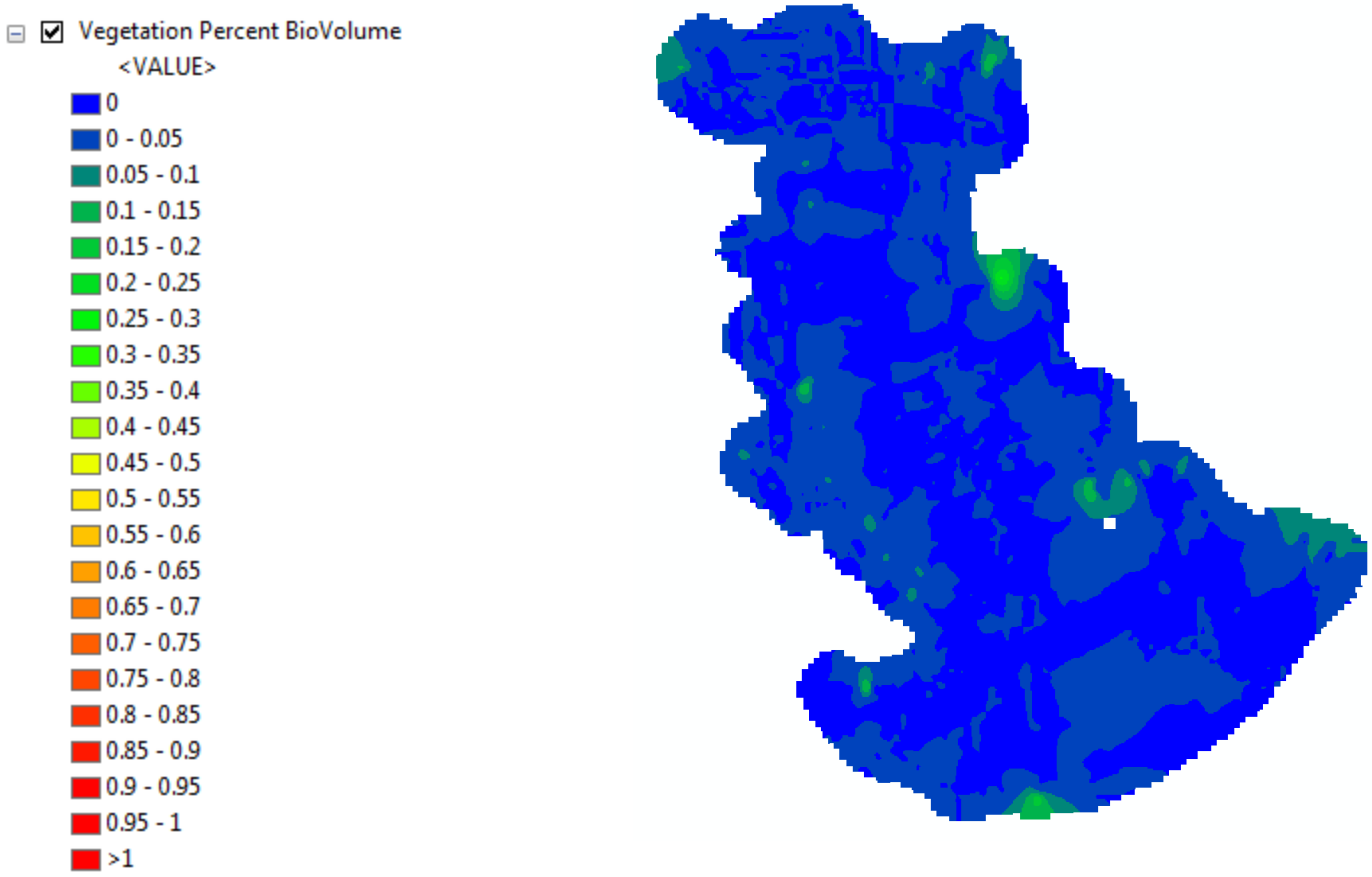
Generally,

20 – 30 m transects yield

1 – 2 ft interval contours

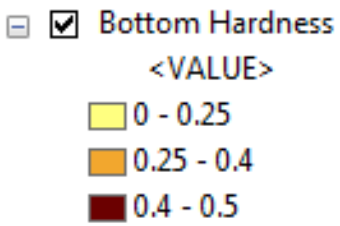
Capabilities: aquatic vegetation maps

- Percent BioViolume 0 to 1



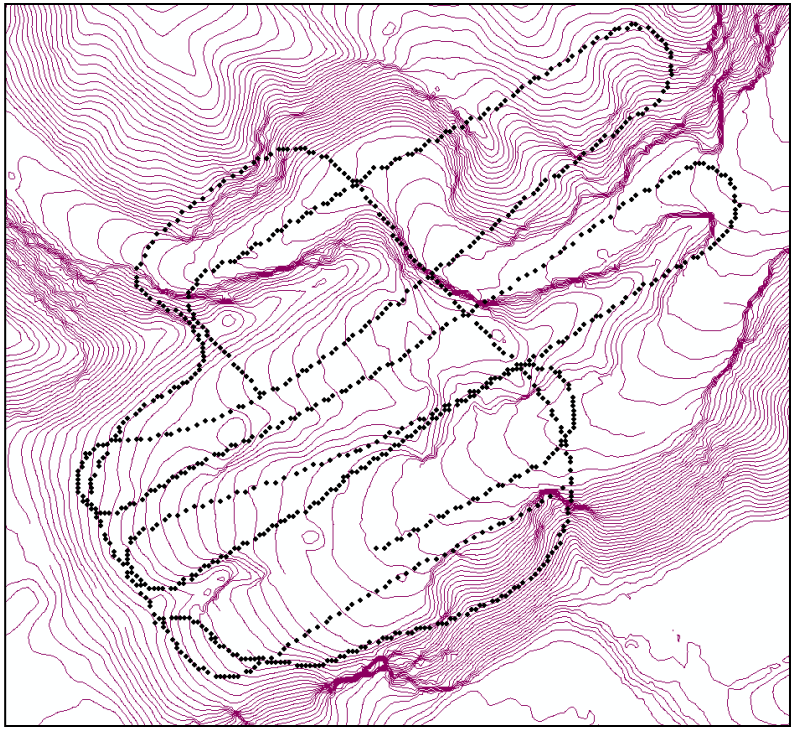
Capabilities: bottom composition maps

- 0 – 0.25 *Soft*
- 0.25 – 0.4 *Medium*
- 0.4 – 0.5 *Hard*



Comparison to Survey Grade Data

Compared 1870 depth points recorded with Lowrance HDS at Temple Bar (2015) to 1 foot interval survey grade contours (2008)



Result

Average Difference: 0.16 feet

Root Mean Square Error: 1.70 feet

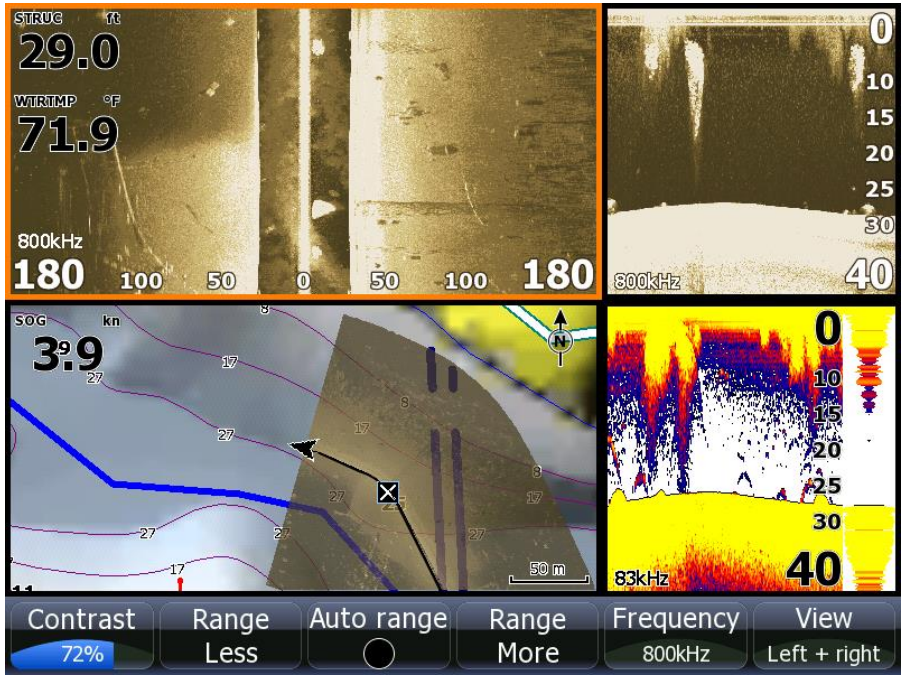
Lessons Learned

- Have not been accounting for transducer offset
- GPS lag on chart plotter
- Review file sizes on HDS before ending data collection
- Wave action affects accuracy

Grant from National Parks Conservation Association to outfit a “survey boat”

Lowrance HDS Chartplotter Generation 2

- Broadband sounder™
- StructureScan™
- StructureMap™

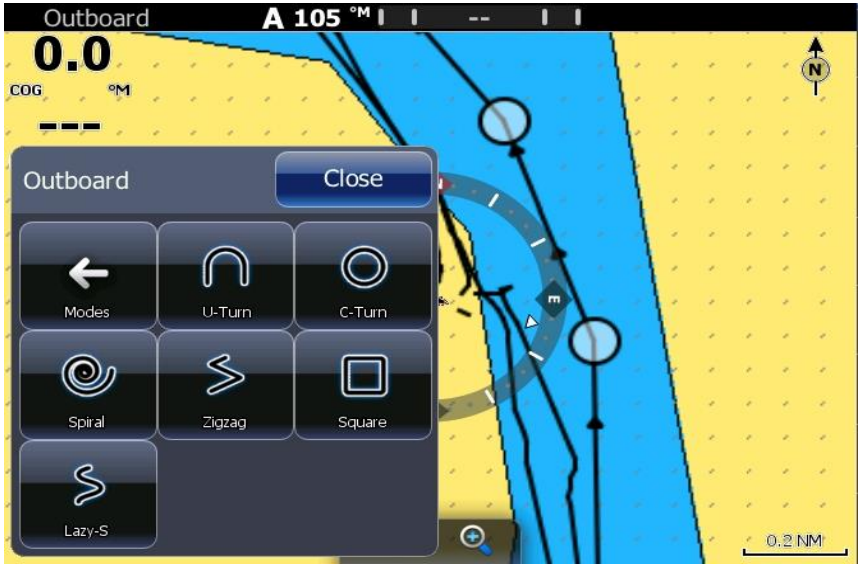


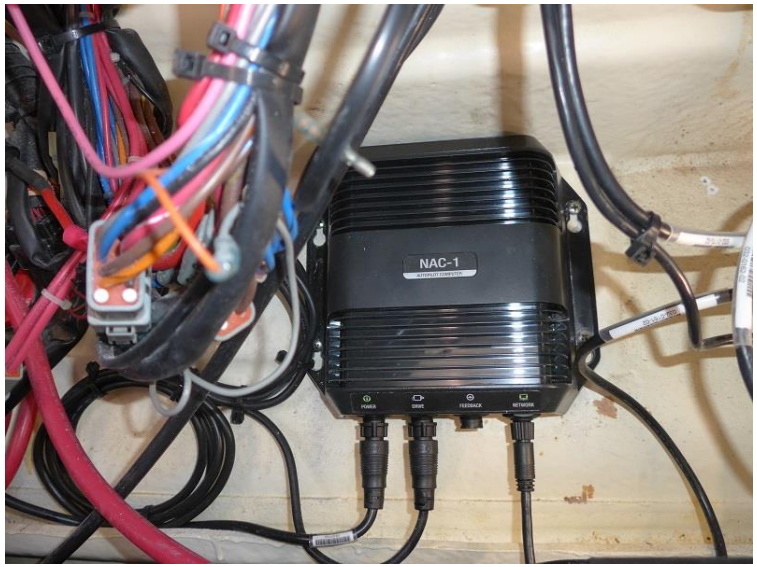
Lowrance HDS Gen 2 System

- 9” HDS-9 Chartplotter
- Point-1 Precision GPS antenna
- M265 in-hull narrow beam transducer

Lowrance Outboard Pilot™ Autopilot

- Hydraulic steering pump
- SmartSteer™ Autopilot computer





Projects

Planned:

- *bathymetric mapping of Lake Mohave*

Possible Future:

- *mapping of substrate hardness relative to quagga mussel colonization densities*
- *underwater vegetation monitoring for invasive species*
- *change detection at Colorado River inflow after high flow events*

Questions?

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